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(54) Abstract Title
Remote power control via a communication line

(57) A single communication line 10 is provided between primary and secondary devices 11, 12, said secondary device having communication circuitry 15D for receiving and decoding digital data from said primary device and control circuitry 15C for controlling the internal operations of said secondary device. Said secondary device comprises a control voltage source Q1 which is controlled by said control circuitry, a power control switch SW1 for applying power to said communication circuitry and said control circuitry, an external power control path 14 coupling said power control switch to said communication line, an internal power control path 16 coupling said power control switch to said control voltage source and means for decoupling said external power control path from said communication line, once power is applied to said communication circuitry and said control circuitry. Said power control switch is reversibly activatable by a control voltage selectively producible by either said primary device or by said control voltage source when power is applied to said control circuitry. Preferably, said power control switch is an optotriac. The method of operation is also claimed.

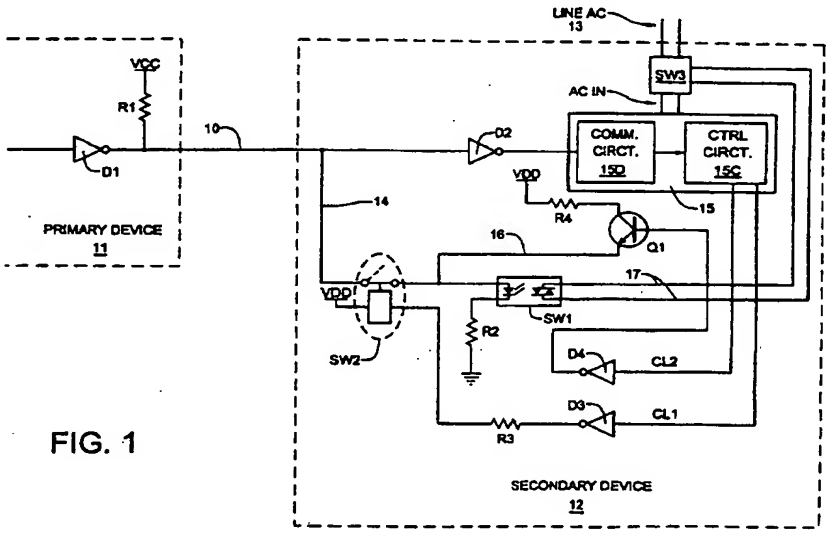

FIG. 1

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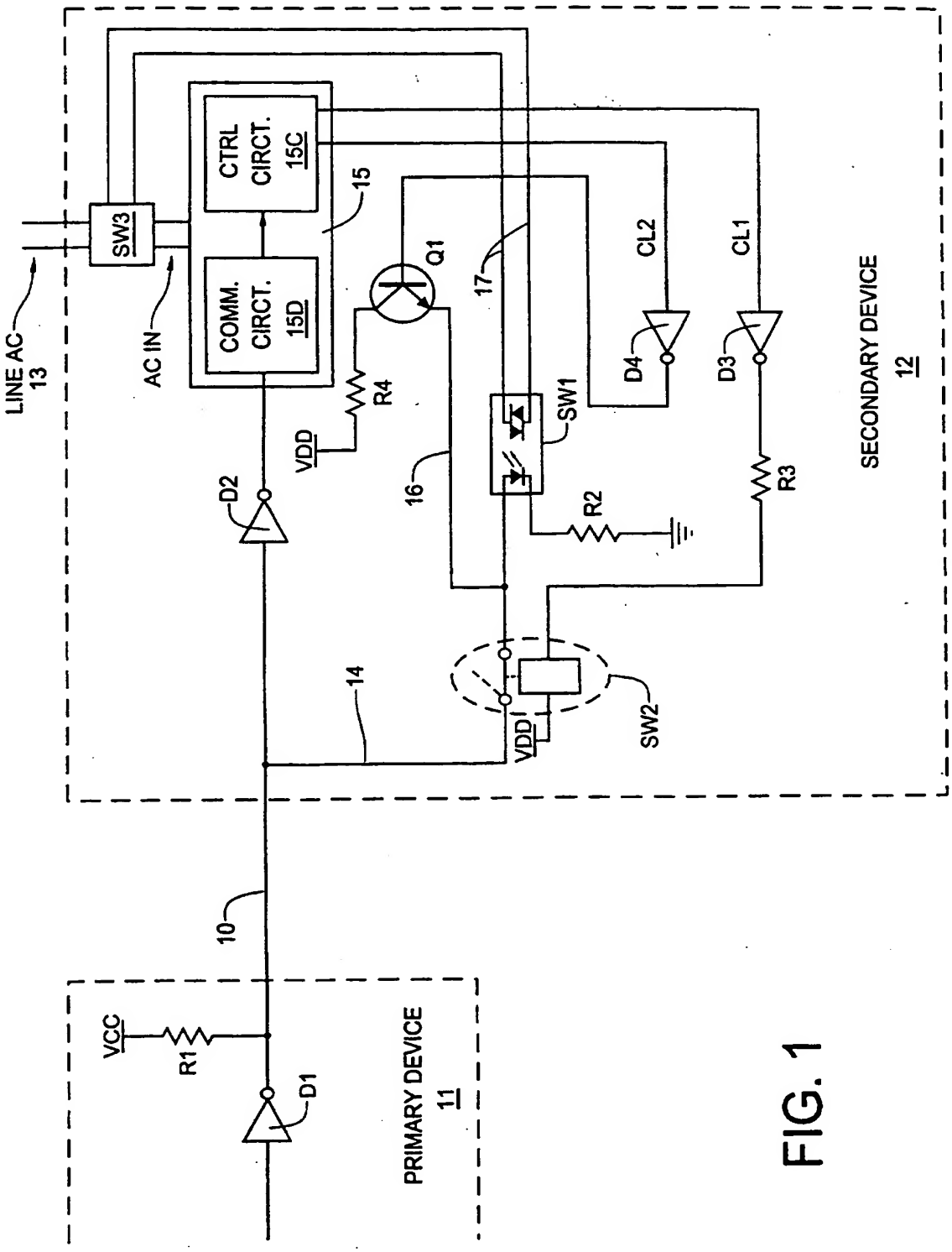
LINE AC
13
AC IN
SW3
CTRL
CIRCT.
15C
COMM.
CIRCT.
15D
15
Q1
17
CL2
CL1
D4
D3
R4
VDD
SW1
D2
16
R2
R3
SECONDARY DEVICE
12
14
VDD
SW2
10
VCC
R1
D1
PRIMARY DEVICE
11

FIG. 1

USE OF A COMMUNICATION LINE TO CONTROL THE SUPPLY OF POWER TO A REMOTE DEVICE

FIELD OF THE INVENTION

This invention relates to methods used to control the supply of power to devices at remote locations which are accessible via a telecommunications link.

BACKGROUND OF THE INVENTION

Electronic devices located at remote locations may need to be controlled from afar. Often, there is little need for the remote device to be powered continuously, as such a scenario merely wastes power and reduces the useful life of the remote device. However, in order for a remote device to communicate with a local device or with other remote devices, it must be turned on. Although providing a mechanism for controlling the power of a remote device is not conceptually difficult separate communication and power control lines are installed between the two locations, provision of a power on/off mechanism becomes more problematic if the only link between the local and remote sites is a communication line. As the distance between the two sites increases, the cost of providing multiple conductive links between the two sites escalates. Because of resistive and impedance loses in a communication cable, signals sent over the cable must be received and retransmitted at discrete intervals along its length. Two lines require double the number of retransmitter devices required by a single line. Twice the number of retransmitter devices necessarily halves the reliability of the power control/communication link between the two sites. Given the cost and reliability factors associated with running multiple conductive lines between two widely separated sites, the potential economic and reliability advantages of being able to control the power to a remote device and communicate with it using a single communication line are obvious.

SUMMARY OF THE INVENTION

This invention includes a method and apparatus for establishing communications over a single communication line between a primary device and a secondary device, which is initially in a dormant state characterized by little or no power consumption. A first driver transmits on the communication line signals fed to it by the primary device electronics. At the secondary device site, a second driver receives data transmitted from the primary device. An external power control path couples a power control switch to the communication line. In order to power up the secondary device, a power-on pulse is sent over the communication line from the primary device to the secondary device. Upon receiving the pulse, the power control switch is activated, thereby triggering a sequence of events that couples the secondary device electronics to an external power source, which is typically an AC power line. The secondary device electronics includes both data communication circuitry and control circuitry. After power has been applied to the secondary device electronics, the secondary device enters a communication mode. When entering the communication mode, the secondary device disables the external power control path and the control circuitry asserts control over the power control switch to ensure an uninterrupted flow of power to the secondary device electronics while the secondary device is in the communication mode. Once the external power control path has been disabled and the secondary device has performed preliminary functions such as, for example, operating system boot-up and/or the execution of diagnostic routines, communications between the primary and secondary devices can commence. Once the required communications between the two devices have been performed, the secondary device may be turned off by transmitting an appropriate shutdown command from the primary device to the secondary device while the latter is still in the communication mode. The shutdown command is decoded by the data communications circuitry, which communicates with the control circuitry. The control circuitry responds by deactivating the power control switch and reenabling the external power control path.

For a preferred embodiment of the invention, the power control switch is an optotriac that is coupled to the communication line via a normally-closed relay. When the optotriac receives the power-on pulse, it connects line current to the secondary device power supply. Once the secondary device is in a power-on state, it applies power to the optotriac in order to maintain the connection of its power supply to the line current. It also simultaneously applies power to the normally-closed relay, thereby decoupling the optotriac from the communication line. Data communications can then be established between the primary device and the secondary device. In order to turn off the secondary device, the secondary device cuts off power to both the optotriac and the relay, thereby placing the secondary device once again in the dormant state.

DESCRIPTION OF THE DRAWINGS

Figure 1 is a block diagram of the apparatus for establishing communications over a single communication line between a primary device and a secondary device for which the power is initially off.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to Figure 1, this invention includes a method and apparatus for establishing serial data communications over a single communication line10 between a primary device 11 and a secondary device 12, which is initially in a dormant state, being decoupled from an external AC power source 13. A first driver D1 transmits signals fed to it by the primary device electronics (not shown). In the depicted embodiment, driver D1 is of the open collector type. Thus, line 10 is normally held at a high level, provided by its connection to VCC through resistor R1, unless grounded through driver D1. At the secondary device site, a second driver D2 receives data transmitted from the primary device. An external power control path 14 couples a power control switch SW1 to the communication line 10. A power-on pulse is sent over the communication line 10 from the primary device 11 to the secondary device 12. Upon receiving the pulse, the power control switch SW1 is activated, thereby

triggering a sequence of events that couples the secondary device electronics 15 to the AC power source 13. The secondary device electronics 15 includes both data communication circuitry 15D and control circuitry 15C. After power has been applied to the secondary device electronics 15, the secondary device 12 enters a communication mode. When entering the communication mode, the secondary device 12 disables the external power control path 14 and the control circuitry 15C asserts control over the power switch SW1 to ensure an uninterrupted flow of AC power to the secondary device electronics 15 while the secondary device 12 is in the communication mode. Once the external power control path 14 has been disabled and the secondary device 12 has performed preliminary functions such as, for example, operating system boot-up and/or the execution of diagnostic routines, communications between the primary and secondary devices can commence. Once the required communications between the two devices have been performed, the secondary device 12 may be turned off by transmitting an appropriate shutdown command from the primary device 11 to the secondary device 12 while the latter is still in the communication mode. The shutdown command is decoded by the data communications circuitry 15D, which communicates with the control circuitry 15C. The control circuitry 15C responds by deactivating the power control switch SW1 and reenabling the external power control path 14.

Still referring to Figure 1, for a preferred embodiment of the invention, the power control switch SW1 is an optotriac which is coupled to ground via resistor R2. The external power control path 14 includes a normally-closed relay SW2, which is controlled by the secondary device electronics 15 via control line CL1 through driver D3 and resistor R3. In this particular embodiment of the invention, driver D3 provides a ground path for the solenoid of relay 15, which is also coupled to VDD. The optotriac SW1 is controllable either through the external power control path 14 when the relay SW2 is closed, or through an internal power control path 16. The internal power control path 16 is controlled by the secondary device electronics 15 via control line CL2, which drives NPN transistor Q1 through driver D4. The collector of transistor

Q1 is coupled to VDD via resistor R4. The emitter output of transistor Q1 is fed to the optotriac SW1 via the internal power control path 16. When the optotriac SW1 receives the power-on pulse from the primary device 11, an output voltage is generated. This output voltage is routed to a main power switch SW3 via AC control lines 17. The output voltage is sufficient to activate the main power switch SW3. Once activated, the secondary device electronics 15 generate a first control signal CL1, which maintains current to the optotriac, and a second control signal CL2, which opens the normally closed relay SW2, thereby disconnecting the external power control path 14 from the optotriac SW1.

Still referring to Figure 1, in order to turn off the secondary device following the completion of the telecommunication session, a shutdown command signal is sent to the secondary device where it is received and decoded by the data-communication circuitry 15D. In response to its receipt of the decoded command, the control circuitry 15C reverses the digital signal on line CL2 so that transistor Q1 is no longer driven, thus deactivating power control switch SW1. Once the power has been cut, the signal on line CL1 goes low, thereby reenabling the external power control path 14.

Although only a single embodiment of the invention has been heretofore described, it will be obvious to those having ordinary skill in the art that changes and modifications may be made thereto without departing from the scope and the spirit of the invention as hereinafter claimed.

CLAIMS

What is claimed is:

1. An apparatus for establishing communications over a single communication line (10) between a primary device (11) and a secondary device (12), said secondary device (12) having both communications circuitry (15D) for receiving and decoding digital data received from the primary device, and control circuitry (15C) for controlling the internal operations of said secondary device (12), said apparatus comprising:

a control voltage source (Q1) within said secondary device (12), said control voltage source (Q1) reversibly activatable by said control circuitry (15C);

a power control switch (SW1) for controlling the application of power to the communication circuitry (15D) and the control circuitry (15C), said power control switch (SW1) activatable by a control voltage selectively producible by either said primary device (11) on said communication line (10) or by said control voltage source (Q1) when power is applied to said control circuitry 915C);

an external power control path (14) normally coupling said power control switch (SW1) to said communication line (10);

means for decoupling said external power control path (14) from said communication line (10) once power is applied to said communication electronics (15D) and to said control circuitry (15C); and

an internal power control path (16) coupling said power control switch (SW1) to said control voltage source (Q1).

2. The apparatus of claim 1, wherein said means for decoupling comprises a normally closed relay (sw2) activatable by said control electronics (15C).

3. The apparatus of claim 1, wherein said power control switch (SW1) is an optotriac.

4. The apparatus of claim 1, wherein said control voltage source (Q1) is a transistor selectively driven by said control electronics (15C).

5. The apparatus of claim 4, wherein said transistor (Q1) is an NPN device having its collector coupled to VDD.

6. The apparatus of claim 3, wherein said optotriac controls a switch (SW3) through which the communications circuitry (15D) and control circuitry (15D) is coupled to an external power source (13).

7. The apparatus of claim 2, wherein decoupling occurs when power to said relay (SW2) is cut when a communication session is complete.

8. The apparatus of claim 1, wherein said control voltage source (Q1) is activated by said control circuitry (15C) when the latter receives power.

9. The apparatus of claim 8, wherein said control voltage source (Q1) is deactivated by said control circuitry (15C) when a communication session is complete.

10. A method of establishing data communications between a primary device (11) and a secondary device (12) at a remote site over a single communication line (10), said method comprising the steps of:

providing a control voltage source (Q1) at the remote site, activatable in response to the application of power to the secondary device (11);

providing a power control switch (SW1) for controlling the application of power to the secondary device (11), said power control switch (SW1) coupled to said control voltage source (Q1) and activatable by a control voltage

selectively producible by either said primary device (11) on said communication line (10) or by said control voltage source (Q1);

providing an external power control path (14) normally coupling said power control switch (SW1) to said communication line (10) when no power is applied to the secondary device (12);

providing means for reversibly decoupling said external power control path (14) from said communication line (10) once power is applied to said secondary device (12);

generating a control voltage at the primary device (11) which is applied to the communication line (10), thereby activating the power control switch (SW1), applying power to the secondary device (12), activating said control voltage source (Q1), and decoupling said external power control path (14); and

initiating a data communications session with the secondary device (12) from the primary device (11).

11. The method of claim 10, which further comprises the step of deactivating said control voltage source (Q1) when the data communications session is complete.

12. The method of claim 10, which further comprises the step of recoupling said external power control path (14) to said communication line (10) in response to the cutting of power to the secondary device (12).

13. The method of claim 10, wherein said power control switch (Sw1) is an optotriac, said means for reversibly decoupling is a normally closed relay (SW2) activatable by the application of power to the secondary device (12), and said control voltage source (Q1) is a transistor that is activated by the application of power to the secondary device.

Application No: GB 0018130.5 **Examiner:** Matthew J. Tosh
Claims searched: All **Date of search:** 27 September 2000

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.R): H3P (PCCX, PLF), H4P (PPC)

Int Cl (Ed.7): G06F 1/32, H04B 1/16

Other: ONLINE: EPODOC, WPI, JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	US 5396636 (IBM CORPORATION). See whole document.	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.